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February 7, 2014

**Via Email**

David De Lorenzo, CSRIC IV, Working Group 1, Task Group 3 Chair  
Polaris Wireless  
[ddelorenzo@polariswireless.com](mailto:ddelorenzo@polariswireless.com)

Re: ATIS ESIF Proposal to CSRIC IV, Working Group 1, Task Group  
3 on Regional Test Beds

Dear David:

On behalf of its Emergency Services Interconnectivity Forum (ESIF), Alliance for Telecommunications Industry Solutions (ATIS) hereby submits the attached document for the consideration of CSRIC IV, Working Group 1, Task Group 3.

ATIS ESIF provides a venue to facilitate the identification and resolution of technical and/or operational issues related to the interconnection of emergency services networks with other networks. Public safety, carriers, and technology providers are represented in ATIS ESIF, and the attached reflects input from these stakeholders concerning a proposal for regional indoor location test beds.

The attached document was developed by ESIF Emergency Services & Methodologies (ESM) Subcommittee. ESIF ESM believes a successful indoor location test bed plan will need to anticipate and accommodate a variety of geographic morphologies, especially given the varying levels of diversity that can exist on a regional basis (for example, building structures and a test site's geographic proximity to a PSAP). As noted in the attached, ESIF ESM expects regional testing will yield more accurate data than exhaustive testing in a single location. ESIF ESM therefore recommends six (6) regional test beds centered around metropolitan hubs, with the knowledge that those test beds would be representative of the various regions across the United States.

Letter to D. De Lorenzo  
February 7, 2014  
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If there are any questions regarding these matters, please do not hesitate to contact me.

Sincerely,



Thomas Goode  
ATIS General Counsel

cc: Laurie Flaherty, CSRIC IV WG 1 Co-Chair, [laurie.flaherty@dot.gov](mailto:laurie.flaherty@dot.gov)  
Brian Fontes, CSRIC IV WG 1 Co-Chair, [bfontes@nena.org](mailto:bfontes@nena.org)  
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## Considerations in Selecting Indoor Test Regions

### Goal

Identify a practical set of regional test beds that are representative of common indoor use environments and use-cases for wireless 911 calls, such that testing conducted across this set of test beds could be expected to reflect performance in other indoor locations where 911 calls are made across the nation.

### Observations

The quantity of regional test beds identified should strike the proper balance between the desire to effectively cover the majority of common use cases from a technical standpoint, and the observation that testing indoors is logistically challenging, time consuming, and expensive. There must be a cost/benefit trade-off as testing resources are finite.

Another non-technical consideration is proximity of a test region to PSAPs/Counties of interest. Broad regional representation is important.

To a certain extent, the parameters affecting indoor location performance may vary across different location technologies. However, many of these parameters are common across most positioning methods currently in use or under development.

Typical Positioning Methods (in use or under development) include:

- AGPS/GLONASS
- UTDOA
- OTDOA
- RF Pattern Matching
- Terrestrial Beacons
- WiFi Proximity
- Active Position Tracking / MEMs Sensors
- Barometric Pressure Sensor – for altitude measurements
- Network Fallback Methods (e.g. AFLT, RTT)

There are also special use cases – such as “small cells” or DAS systems – which because of their unique nature should have location performance studied and/or extrapolated separately.



**Parameters that may affect indoor location performance include:**

1. Location technology (or system of technologies) under test
2. Radio Access Network (RAN)
  - 2G
  - 3G
  - 4G
3. Location technology configuration options employed by the wireless service provider or location technology vendor
  - Downlink synchronization
  - Use of PRS, PRS coordination/muting – for OTDOA
  - LMU deployment density – for UTDOA
  - Quality of assistance information
  - Bandwidth of Terrestrial Beacon downlink
  - Quality of WiFi Access Point database
  - Quality of RF Pattern Matching database
  - Quality/locality of atmospheric pressure database
4. Quantity/Density of surrounding transmission sources
  - Macro Cellsites
  - Satellites
  - WiFi Access Points
  - Terrestrial Beacons
5. Geometry of surrounding transmission sources
  - Latitude – for Satellite-based Methods
  - “Edge-of-Coverage” effects for terrestrial-based multilateration methods; i.e., situations where beyond a certain boundary/region (such as a coastal line) no transmission sources reside
  - String of pearls
6. Average cell coverage radius for surrounding macro cells
  - Affects round trip timing measurements
7. “Morphology”
  - Dense Urban
  - Urban
  - Suburban
  - Rural



8. Building-under-test and surrounding buildings
  - Building spacing
  - Height
  - Construction Materials (influences RF attenuation and reflections)
  - Building usage (commercial or retail, residential, industrial, special use facility) influences interior walls, wireless deployment, and 9-1-1 use case scenarios.
  
9. HVAC systems or other factors affecting in-building barometric pressure accuracy

For areas of comparable density, experience has shown that performance of a given positioning method is affected more by the underlying configuration options employed by the wireless service provider or location technology vendor than by the specific area tested. For example, OTDOA performance in a certain type of environment depends more on how Positioning Reference Signals (PRS) are utilized (including the use of PRS coordination/muting) than on where the test is conducted.

There will always be “corner cases” that are not practical to specifically test, such as a houseboat in a remote canyon, a secluded mountain cabin, an isolated island, etc.

### **Recommendations**

The consensus within the ESIF-ESM is that more thorough testing of a fairly small number of test regions is preferable to lightly testing in a larger number of test regions.

ESIF ESM recommends the following regional test beds:

1. San Francisco Bay Area
  - a. Pacific region
  - b. Represents: LA, Seattle, San Diego, Portland, San Jose
  - c. If testing occurs on the peninsula, it might be able to replicate an island test
  
2. Chicago
  - a. Midwest region
  - b. Lake/shoreline
  - c. Dense urban core
  - d. Extensive urban residential areas
  - e. Extends to rural Midwest surroundings
  - f. Represents: Cincinnati, Detroit, Cleveland, St. Louis, Minneapolis, St. Paul, Milwaukee, Indianapolis, Columbus
  
3. Atlanta
  - a. South region
  - b. Southeast example
  - c. Includes heavily forested mountain terrain

